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THE SUBARCTIC ODONATA OF NORTH AMERICA

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More or less comprehensive lists have been published of the Odonata of the Canadian provinces and recently Mrs. Gloyd ('39) has brought together all the available records for Alaska, but very little has yet appeared regarding the species which inhabit the other northern parts of North America, viz., Newfoundland, Labrador and the Northwest and Yukon Territories of Canada.

The data on these regions are still exremely meagre, but in the past few years collections have been made in the subarctic regions, particularly the coast of Hudson Bay in Manitoba and Ontario, which, together with Whitehouse's ('41) records from Atlin, in extreme northern British Columbia (60° N. Lat.), the Alaskan records and the scattered data from other regions, give a fairly good picture of the subarctic or Hudsonian fauna of this group.

Newfoundland, the Northwest Territories and Yukon Territory do not lie wholly within the arctic and subarctic (Hudsonian) regions and, conversely, the subarctic regions are not situated wholly outside the provinces. On the one hand, e.g., there is a long tongue of the Canadian zone, which extends northward down the MacKenzie Valley, while, on the other hand the shores of Hudson Bay, within the Provinces of Manitoba, Ontario and Quebec are Arctic and subarctic.

Accordingly we have had two objects in mind in preparing this paper, viz: (1) to list the subarctic species of North American Odonata, or those of the Hudsonian zone, these being the most northerly species on the continent; and (2) to bring together the available records of Odonata from Labrador, Newfoundland and the Canadian Territories.

Most of the records presented herewith have been published already but are scattered through a number of papers. The most recent of these in which collections of considerable extent are recorded are the following: Mrs. Gloyd's ('39) synopsis of the Odonata of Alaska, Whitehouse's ('41) work on the British Columbia species, which includes records from Atlin in the extreme north of the Province, and two recent papers by the present writer (Walker '41a, '41b), the first listing species from the vicinity of Churchill, Man., and the second from Fort Severn, Hudson Bay, which lies within the Hudsonian zone of Ontario.

The principal material recorded here for the first time is a collection of 233 specimens, representing 20 species, taken by Dr. F. A. Urquhart during the summer of 1942 on the west coast of James Bay, Ont., chiefly at Fort Albany, and deposited in the Royal Ontario Museum of Zoology, Toronto. We have also received 13 specimens, belonging to four species, from the Wapus River, Reindeer Lake, Sask. (56° N. Lat.), collected in August, 1942, by Dr. D. S. Rawson and seven from the west coast of Hudson Bay, received from Mr. G. S. Brooks. These include five specimens from Churchill, Man., and two from Eskimo Point, N. W.T. These collections together with a larger one taken by C. E. Hope at Fort Severn, Ont., and already included in the writer's Ontario list (Walker '41b), have added greatly to our knowledge of the odonate fauna of the Hudsonian zone, and we have pleasure in expressing our thanks to these colleagues for their generous co-operation. We are also indebted to Dr. Philip P. Calvert for a list of species from Labrador, collected by Drs. Allen and Townsend, and determined by himself.

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LIST OF SPECIES

Agrion aequabile hudsonicum Hagen.

Moosonee, James Bay, Ont. (Walker '40). Also observed, but not collected, at Fort Albany, Ont., by Dr. F. A. Urquhart and Mr. C. E. Hope.

The Fort Albany record is the only strictly Hudsonian one but, besides Moosonee, it has been reported from two other localities near this zone, viz., the Favourable Lake region and the Kenogami River, both in the Patricia portion of the Kenora District, Ont., and we have seen specimens from the Laurentides Park, Que., received from Dr. V. D. Vladykov.

Lestes dryas Kirby.

Natashquan, north shore of the Gulf of St. Lawrence, and East Main, James Bay, Que. (Walker '34); Nettitichi Point, James Bay, Ont., July 14 (Walker '41b); Fort Norman, MacKenzie River, N. W. T., Aug. 6 (C. H. Crickmay). Also recorded from several localities in Alaska (Gloyd '39) of which one at least appears to be subarctic, viz., Chitina (61° 30' N. Lat.).

Circumpolar and widely distributed across Canada and the northern United States.

Lestes disjunctus Selys.

Moisie Bay, north shore of the Gulf of St. Lawrence, Que. (Eidmann '35); East Main, James Bay, Que. (Walker '34); Wapus River, Reindeer Lake, Sask., Aug. 25, 2 ♂, 2 ♀ (D. S. Rawson); Atlin, B. C. (Whitehouse '41). Also recorded from several localities in Alaska, some of them probably subarctic, e.g., Anchorage (61° 10' N. Lat.) and Gulkana (62° 10').

This is the common Lestes of the north and the absence of records from the Canadian Territories signifies only that scarcely any collecting has been done in these regions. The lack of specimens from Fort Severn and Fort Albany, Ont., may be due to the fact that no collecting was done in these localities after the end of July. The specimens from the Wapus River are small but rather more robust than usual.

Enallagma boreale Selys.

White Bay, Newfoundland (Selys '75, type locality); Bay of Islands, Nfd. (Williamson '06); Spruce Brook, Nfd. (Walker '16); Moisie River, Que. (Eidmann '35); Fort Albany, James Bay, Ont., June 17–20, 4 ♂, 1 ♀ (F. A. Urquhart); Fort Severn, Hudson Bay, Ont., July 15 (Walker '41b); Fort Norman, MacKenzie River, N. W. T., June 29 (C. H. Crickmay); Atlin, B. C. (Whitehouse '41). Also reported from Alaska, at least one of the localities (Gulkana) being subarctic.

Generally distributed in Canada from the Hudsonian zone southward; most abundant in the Canadian zone. While variable in linear dimensions, specimens from the Canadian and Hudsonian zones average somewhat larger than those from the Transition zone and are more robust.

Enallagma cyathigerum (Charp.)

Bay of Islands, Nfd. (Williamson '06); Grand Entry, Magdalen Is., Que. (Williamson '02); Fort Albany, James Bay, Ont., June 29, 1 ♂ (F. A. Urquhart); Fort Norman, MacKenzie River, N. W. T. (C. H. Crickmay); Great Slave Lake region, June 27 (J. Russell); Fort Resolution, Great Slave Lake, N. W. T. (Hagen '75); Atlin, B. C. (Whitehouse '41).

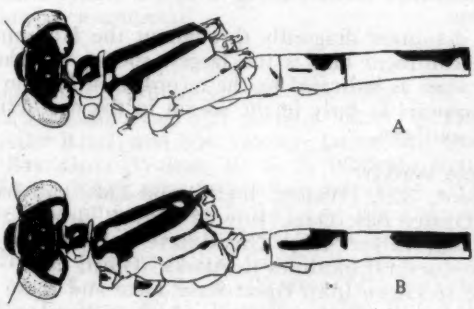
The general distribution of this circumpolar species in Canada is similar to that of *E. boreale* except that it is much more abundant in the western half of the country than the eastern, becoming local and sporadic east of Lake Superior. It has been reported from several localities in Alaska (Gloyd '49).

Coenagrion resolutum (Hagen).

Spruce Brook, Nfd. (Walker '16); Grand Entry, Magdalen Is., Que.

(Williamson '02); Natashquan, Que., and East Main, James Bay, Que. (Walker '34); Tidal Creek, James Bay, Ont. (Walker '41b); Fort Albany, James Bay, Ont., June 15 to July 2, 36 ♂, 20 ♀ (F. A. Urquhart); Fort Severn, Hudson Bay, Ont. (Walker '41b); Churchill, Man. (Walker '41a); Fort Resolution, Great Slave Lake, N. W. T. (Selys '75); Great Slave Lake region, June 27 (J. Russell); Atlin, B. C. (Whitehouse '41). Also recorded from Anchorage, Gulkana and Palmer, Alaska (Ahrens '38), and from various localities in northern Ontario which are near the Hudsonian zone (Favourable Lake, Attawapiskat Lake, and Moosonee, James Bay).

Specimens from the coast of Hudson Bay and probably other Hudsonian localities are generally more robust than those from localities near the southern limit of the range of this species. The dark markings of the thorax and basal abdominal segments are usually more extensive. The dark streak in the suture between the meso- and metapleura is a characteristic mark of northern specimens and the pale humeral bands are more frequently divided like an exclamation mark (fig. A and B). The lateral black streaks on the second abdominal segment are likewise heavier and connected with the median spot. Prof. B. E. Montgomery, who examined the type of *Agrion servum* Selys ('76) in the Museum of Comparative Zoology, Cambridge, sent the writer a drawing of this specimen, which was taken at Fort Resolution, Great Slave Lake. It is identical with the heavily marked specimens of *C. resolutum* from Hudson Bay with divided humeral bands. Since there is complete intergradation between these forms and since the variations are not entirely geographical, we consider it unnecessary to recognize *servum* even as a race, particularly since the type locality of both *resolutum* and *servum* is the same.



Coenagrion resolutum (Hagen)

A, Male from Toronto. B, Male from Fort Severn, Hudson Bay, Ont.

Coenagrion interrogatum (Hagen).

Spruce Brook, Nfd. (Walker '16); Thunder River, Que. (Walker '34); Fort Albany, James Bay, Ont., June 14–25, 4 ♂, 1 ♀ (F. A. Urquhart); miles 256, and 332, Hudson Bay Ry., Man.

The Fort Albany record is the first definitely Hudsonian one, although it has long been expected to inhabit this zone, since the southern boundary of its range is farther north than that of any other species of North American Zygoptera. It has been taken in other localities near the Hudsonian boundary, such as Favourable Lake, Ont. (Walker '40), and Nordegg, Alta. (Whitehouse '18).

Aeschna eremita Scudder.

White Bay, Nfd. (Selys '75, as *A. hudsonica*). Bay of Islands and Grand

Lake, Nfd. (Williamson '06 as *A. clepsydra*); Hopedale, Labrador (Walker '12); Natashquan and Bradore Bay, Que. (Walker '34a); Atik River, Hudson Bay slope, Que., 45 miles from mouth (Walker '12*); Fort George, James Bay, Que., Aug. 7 (E. S. Pentland); Point Comfort, James Bay, Que., July 18, 19 (Walker '41b); Moosonee, James Bay, Ont. (G. S. Walley and Walker '40); Nettitichi Pt., James Bay, Ont., July 14 (Walker '41b); Fort Albany, James Bay, Ont., July 5, 1 ♀; Big Piskwamish, James Bay, Ont., July 21, 4 ♀; and Kabiskaubakau, James Bay, Ont., July 18, 1 ♀ (F. A. Urquhart); Fort Severn, Hudson Bay, Ont., July 20, 7 ♂ (Walker '41b); Wapus River, Reindeer Lake, Sask., Aug. 26, 2 ♂ (D. S. Rawson); Athabasca Lake and Tazin Lake, Alta., July 4-11 (F. Hooper); Eskimo Pt., Hudson Bay, N.W.T., Aug 20, 1941, 1 ♀ (D. B. Marsh); Fort Resolution, Great Slave Lake, N.W.T. (Hagen '75); Great Slave Lake region, June 27 (J. Russell); Reliance, N.W.T., July 13 (C. H. D. Clarke); Fort Simpson, MacKenzie River, N.W.T., June 29 (C. H. Crickmay); Cameron Bay, Great Bear Lake, N.W.T., July 4-21 (T. N. Freeman); Aklavik, MacKenkie River delta, N. W. T. (S. Hadwen); Atlin, B. C. (Whitehouse '41). Also recorded from a number of localities in Alaska (Gloyd '39), of which Gulkana appears to be the most northern.

This is a dominant dragonfly throughout the Hudsonian and Canadian zones across the continent and is the largest species in that region. It even enters the Arctic zone as indicated by the record from Eskimo Point. The dates indicate that it appears as early in the season in the northern part of its range as it does in the southern.

Aeschna interrupta Walker.

Spruce Brook, Nfd. (Walker '16); Grand Lake and Bay of Islands, Nfd. (Walker '12); Trinity Bay, Que., July 22 (W. J. Brown); Moosonee, James Bay, Ont., July 16 (Walker '41b); Great Slave Lake, N. W. T. (Walker '12). Also recorded from several localities in Alaska (Gloyd '39).

The single specimen from Great Slave Lake and those from Chitina and Palmer, Alaska, belong to the race *lineata*, which is characteristic of the Central Plains. Specimens from Newfoundland and Quebec and the one from James Bay are of the race *interrupta*.

The specimens reported as this race by Mrs. Gloyd from Admiralty Island and Ketchikin, Alaska, doubtless belong to the coastal form which approaches the eastern *interrupta* so closely as to be sometimes scarcely distinguishable from the latter. It nevertheless appears to represent a distinct population, which intergrades in British Columbia with *nevadensis*. A careful study of the races of this species in Western North America is needed.

A. interrupta is a species of the Canadian zone but evidently penetrates the Hudsonian to some extent, as some of the above records indicate.

Aeschna juncea americana Bart.

St. John's, Nfd., July 1 (A. English); Hopedale, Labrador, Aug. 2-Sept. 1 (Gibson '18, W. W. Perrett); Nain, Labrador, June 20-July 25 (P. Hettasch, W. W. Perrett); Natashquan, Thunder River, Bradore Bay, and Mt. Lyall, Que., 1500 ft. (Walker '34); Moisie Bay, Matamik River, Que. (Eidmann '35); Fort George, James Bay, Que., Aug. 7 (Walker '34); Nettitichi Pt., James Bay, Ont., July 14 (Walker '41b); Moosonee, James Bay, Ont., July 18 (G. S. Walley, Walker '40); Fort Albany, James Bay, Ont., July 2, 1 ♀ (F. A. Urquhart); Fort Severn, Hudson Bay, Ont., July 15-21 (Walker '41b); Churchill, Man., July 4-16 (Walker '41a), and July 31, 1942, 1 ♂ (G. S. Brooks); Eskimo Pt., Hudson Bay, N. W. T., Aug. 20, 1941, 1 ♀ (D. B. Marsh); Fort Restolution, Great Slave Lake, N. W. T. (Hagen '75); Fort Rae, Great Slave Lake region, N. W. T., Aug. 12

*Atik River was incorrectly located in the Hudson Bay Territory in the writer's monograph (Walker '12).

(J. Russell); Fort Wrigley, MacKenzie River, N. W. T., July 25 (C. H. Crickmay); Cameron Bay, Great Bear Lake, N. W. T., July 5, 11, Aug. 6 (T. N. Freeman); Aklavik, MacKenzie River delta, N. W. T. (S. Hadwen); White Horse, Yukon Terr., July-Aug. (R. P. Hawes); Atlin, B. C. (Whitehouse '41); Also recorded from many localities in Alaska (Gloyd '39).

A circumpolar species, the race *americana* being common in the Hudsonian zone across the continent. With *A. eremita* it reaches the Arctic zone at Eskimo Point.

Aeschna subarctica Walker

Magdalen Is., Thunder River, Anticosti Is., and Fort George, James Bay, Que. (Walker '34); Big Piskwamish, James Bay, Ont., July 2, 1 ♂ (F. A. Urquhart); Cameron Bay, Great Bear Lake, N. W. T., July 14, 22, 1 ♂, 1 ♀ (T. N. Freeman): Also recovered from Ontario, Manitoba and British Columbia.

The occurrence of this holarctic species at Fort George, Big Piskwamish and Cameron Bay, Great Bear Lake, indicates conclusively that it is a Hudsonian form. It appears to have the same general distribution as its near relative *A. juncea*, but is much less common.

Aeschna sitchensis Hagen.

Bay of Islands, Nfd. (Williamson '06); St. John's, Nfd., Aug. 1 (J. M: Swaine); Hopedale, Labrador, Aug. 5-24 (Gibson '18, W. W. Perrett); Magdalen Is., Anticosti, Thunder River, and Fort George, James Bay, Que. (Walker '34); Moosonee, James Bay, Ont. (Walker '40, G. S. Walley); Nettitichi Pt., James Bay; Ship Sands, Moose River, near James Bay, July 13-14 (Walker '41b); Fort Albany, James Bay, Ont., June 25-July 2, 2 ♂, 1 ♀; Big Piskwamish, James Bay, Ont., July 21, 24 ♂, 15 ♀ (F. A. Urquhart); Fort Severn, Hudson Bay, Ont., July 2-21, 3 ♂, 26 ♀ (Walker '41b); Churchill, Man. (Walker '41a); Fort Resolution, Great Slave Lake, N. W. T. (Walker '12); Caribou Is., Great Slave Lake region, N. W. T., June 26 (J. Russell); Atlin, B. C: (Whitehouse '41). Also recorded from several Alaskan localities.

This is a typical Hudsonian species but occurs also in many parts of the Canadian zone, becoming fairly general northward.

The preponderance of females in the series from Fort Severn is not duplicated in collections from other localities.

Aeschna coerulea septentrionalis (Burm.)

Grand Lake, Nfd. (Williamson '06); Great Caribou Is., Labrador, Aug. 1 (Allen and Townsend); Hopedale, Labrador, July 12-Sept. 16 (Gibson '18, W. W. Perrett); Hamilton Inlet, Labrador, July 13, and Davis Inlet, Labrador, July 19 (W. W. Perrett); Bradore Bay and Seven Isles, north shore of the Gulf of St. Lawrence, Island near Cape Hope and Fort George, James Bay, Que. (Walker '34); Fort Albany, James Bay, Ont., June 20-July 2, 11 ♂, 9 ♀ (F. A. Urquhart); Fort Severn, Hudson Bay, Ont., July 3-20, 16 ♂, 21 ♀ (Walker '41b); Churchill, Man. (Walker '41a); Fort Resolution, Great Slave Lake, N. W. T. (Hagen '75); N. W. Hanbury River, Portage Grove Falls, N. W. T., July 6-8 (Hornby and Bullock); Cameron Bay, Great Bear Lake, N. W. T., July 5, 21 (T. N. Freeman); Aklavik, MacKenzie River delta, N. W. T. (S. Hadwen); Atlin, B. C. (Whitehouse '41).

This is one of the two most exclusively subarctic species of American Odonata, the other being *Somatochlora septentrionalis*. Apart from the above records it has been reported only from "Saskatchewan" (which may refer to what is now northern Manitoba (Hagen '75); Banff, Alta. (Walker '34b), Nova Scotia (Hagen '61) and the White Mts., N. H. It is thus apparently a "boreo-alpine" species.

As a species, *A. coerulea* Ström is circumpolar. The typical form ranges

into somewhat milder latitudes than the North American race.

Aeschna palmata Hagen.

Atlin, B. C. (Whitehouse '41). Also recorded from a number of Alaskan localities, all of which, however, seem to be south of the subarctic regions.

This is one of the commonest of western Aeschnas, and is abundant all through British Columbia. It is one of the very few truly boreal Odonata that are confined to the Cordillera. The type, however, comes from Kamtchatka (Hagen '56).

Aeschna umbrosa Walker.

Spruce Brook, Nfd. (Walker '16); Humbermouth, Nfd. (Walker '12); Labrador ((Hagen '61, as *A. constricta*); Anticosti Is., Que. (Walker '34); Wapus River, Reindeer Lake, Sask., Aug. 25-26, 3 ♂, 1 full-grown nymph (D. S. Rawson); Yukon Terr., 62° 31'-63° 6' N. Lat., 137° 30'-139° 30' W. Long. (A. D. Cairns).

Widely distributed across the continent; most abundant in the Canadian and Transition zones.

Ophiogomphus colubrinus Selys.

Newfoundland (Selys '58); Hudson Bay and Port Neuf, Que. (Selys '58, Hagen '75); Fort Albany, James Bay, Ont., June 24-July 2, 2 ♂ (F. A. Urquhart); Fort Severn, Hudson Bay, Ont., July 15, 19, 4 ♂, 4 ♀ (Walker '41b); mile 332, Hudson Bay Ry., Man. (Walker '33); Wapus River, Reindeer Lake, Sask., Aug. 25, 1 full-grown nymph, and Aug. 26, 4 nymphs from stomach of pike, 3 full-grown, 1 penultimate (D. S. Rawson).

This is the most northerly American gomphid and has been reported from a number of localities from Newfoundland to British Columbia (Whitehouse '41). The specimens from Fort Severn were taken from the Severn River, near the mouth, and were all newly emerged. The two males from Fort Albany were also teneral. These records definitely place *O. colubrinus* in the Hudsonian fauna and there is every reason to believe that it is widely distributed in that zone. It is common throughout the Canadian zone, where clear rapid streams occur, particularly in the northern parts (north shore of Lake Superior, Favourable Lake region, Mattagami River, etc.).

Cordulia shurtleffi Scudder.

White Bay, Nfd. (Selys '75); Bay of Islands, Nfd. (Williamson '06); Spruce Brook, Nfd. (Walker '16); St. John's, Nfd., June (A. English); Northwest River, Hamilton Inlet, Labrador, July 6-15 (W. W. Perrett); Thunder River, Que. (Walker '34); Fort Albany, James Bay, Ont., June 15-July 5, 20 ♂, 21 ♀ (F. A. Urquhart); Churchill, Hudson Bay, Man. (Walker '41a); Fort Chipewyan, Lake Athabasca, Alta., June 18 (F. Harper); Fort Resolution, Great Slave Lake, N. W. T. (Hagen '75); Fort Rae, Great Slave Lage region, N. W. T., July 8 (J. Russell); Reliance, N. W. T., July 11 (C. H. D. Clarke); Atlin, B. C. (Walker '34).

This is one of the most abundant dragonflies of the Canadian zone, but also occurs in the Hudsonian, as indicated by some of the above records, such as Hamilton Inlet, Fort Albany, Churchill and Atlin. A number of Alaskan records are cited by Mrs. Gloyd ('39), some of which are well within the Hudsonian zone, e.g., Fort Yukon (66° N. Lat.).

Somatochlora walshii Scudder.

This species is included in the list only on the basis of a record from East Main, James Bay, Que. (Walker '25). It has also been found at Nordegg, Alta. (Whitehouse '17) associated with Hudsonian species. It is chiefly a species of the Canadian zone and ranges across the Continent.

Somatochlora minor Calvert.

East Main, James Bay, Que. (Walker '25); Bradore Bay, Que. (Walker '34a); Fort Albany, James Bay, Ont., 1 ♂, teneral and yellow-winged (F. A. Urquhart); mile 256, Hudson Bay Ry. (Gibson '18); Gillam, Man. (Walker '41a).

Fort Albany and Gillam are in the Hudsonian zone and East Main is on the edge of it, but on the whole this species, like *S. walshii,* belongs to the Canadian zone and is transcontinental.

Somatochlora franklini Selys.

Great Caribou I., Labrador, July 27 (Allen and Townsend); Nain and Hopedale, Labrador (Walker '25); Hopedale, Labrador, July 25-Aug. 27 (W. W. Perrett); Northwest River, Hamilton Inlet, Labrador, July 13-15 (W. W. Perrett); East Main and Fort George, James Bay, Que. (Walker '25) Moosonee, James Bay, Ont., July 16-21 (G. S. Walley, S. C. Downing); Nettitichi Pt., James Bay, Ont., July 14 (Walker '41b); Fort Albany, James Bay, Ont., June 19-July 5, 10 ♂, 3 ♀ (F. A. Urquhart); Big Piskwamish, James Bay, Ont., July 21, 3 ♂, 1 ♀ (F. A. Urquhart); Fort Severn, Hudson Bay, Ont., July 5-20, 28 ♂, 43 ♀ (Walker '41b); Churchill, Man. (Walker '41a), and July 31, 1942, 1 ♀ (G. S. Brooks); Fort Resolution, Great Slave Lake, N. W. T. (Hagen '75); Caribou I., Great Slave Lake, N. W. T., June 26 (J. Russell); Fort Simpson, MacKenzie River, N. W. T., June 25 (C. H. Crickmay); Atlin, B.C. (Whitehouse '41).

Abundant in the muskegs of the northern parts of the Canadian and Hudsonian zones. It is a curious fact that females have been in the majority in nearly all the collections that we have examined.

Somatochlora kennedyi Walker.

Fort Resolution, Great Slave Lake, N. W. T. (Walker '25); Caribou I., Great Slave Lake, N. W. T., June 26 (J. Russell); Fort Simpson, MacKenzie River, N. W. T., June 25 (Walker '25).

This is chiefly a species of the Canadian zone but evidently reaches the southern border of the Hudsonian, as indicated by the above records. It is not recorded from the provinces west of Manitoba, but is fairly common from this province eastward to the Maritimes.

Somatochlora forcipata Scudder.

Newfoundland (Selys '75); Grand Lake, Nfd. (Williamson '06); Hopedale, Labrador, July 8-Aug. 31 (Walker '25); Ashwanipi River, Thunder River and Natashquan, Que. (Walker '34); Fort Resolution, Great Slave Lake, N. W. T. (Selys '71).

This species is common in the Maritime Provinces and has been taken as far west as the vicinity of Banff, Alta. (Walker '27). The many records from Hopedale place it definitely in the Hudsonian fauna but it appears to be mainly a species of the eastern part of the Canadian zone. It is not represented in the collections from the Patricia region but it has been received from Smoky Falls, Mattagami River, Ont. (R. D. Whelan) and the Pas, Manitoba (Walker '33).

Somatochlora semicircularis Selys, the common Cordilleran species of the *arctica* group, has been reported from two localities in Alaska and is found at considerable elevations in British Columbia and the Alberta Rocky Mountains, often where conditions are indicative of the Hudsonian zone. While still unknown from the general area of this zone and from any part of the Yukon and Northwest Territories and therefore tentatively excluded from the present list, it may be expected to occur within the Cordilleran area of the Hudsonian.

Somatochlora whitehousei Walker.

Hopedale, Labrador, Aug. 2, 28 (Walker '25); Rupert Bay, James Bay,

Que. (Walker '25); Fort Severn, Hudson Bay, Ont., July 4-20, 36 ♂, 56 ♀ (Walker '41b); Churchill, Man. (Walker '41a); mile 332, Hudson Bay Ry. (Walker '25).

This is a truly Hudsonian species, whose known range reaches from the Labrador coast to Revelstoke, B. C.

The only large series is from Fort Severn, where this species was apparently one of the most abundant dragonflies. All of the specimens in this series are young, many of them teneral.

Somatochlora septentrionalis Selys.

Grand Lake, Nfd. (Williamson '06); Labrador (Hagen '75); Cape Charles, Labrador, July 28 (Allen and Townsend); Hopedale, Labrador, July 15-Aug. 30 (Walker '25); Northwest River, Hamilton Inlet, Labrador, July 15 (W. W. Perrett); Anticosti I., Seven Isles, and Point Comfort, James Bay, Que. (Walker '34); Fort Albany, James Bay, Ont., June 29, 1 ♀ (F. A. Urquhart); Big Piskwamish, James Bay, Ont., July 21, 1 ♂ (F. A. Urquhart); Fort Severn, Hudson Bay, Ont., July 20, 21, 2 ♀ (Walker '41b); Fort Simpson, MacKenzie River, N. W. T. (Selys '71); Atlin, B. C. (Walker '27, Whitehouse '41).

This is another strictly Hudsonian species but, unlike other such species, it has not been recorded in the Cordilleran region south of Atlin, B. C. It is common on the Labrador coast where *S. whitehousei* appears to be rare, while on the shores of Hudson Bay the reverse is the case. On the other hand Whitehouse found it in small numbers at Atlin, where *S. whitehousei* was not observed. Both are muskeg species and appear to have similar haunts and habits of oviposition.

Somatochlora sahlbergi Trybom.

Kushokwim River, Alaska (Kennedy '18, as *S. walkeri* n. sp.; Walker '25).

A palaearctic species of subarctic range, reported from the lower Yenesei River, Siberia (Trybom '89), Léna, Siberia (Walker '25), and northern Finland (Valle '20, '31).

Somatochlora albicincta (Burm.).

Bay of Islands, Nfd. (Williamson '06); Spruce Brook, Nfd. (Walker '16); Labrador (Selys '71); Winthem and Hopedale, Labrador, July 24-Aug. 31 (Walker '25); Nain, Labrador, Aug. 13-20 (Walker '25); headwaters of Moisie River, Seven Isles, Thunder River, Mt. Albert, and East Main, James Bay, Que. (Walker '34); Fort Severn, Hudson Bay, Ont., July 3-21, 2 ♂, 3 ♀ (Walker '41b); Churchill, Man. (Walker '41a); Atlin, B. C. (Whitehouse '41). Also recorded from a number of Alaskan localities of which the most northerly appears to be Fort Yukon (66° N. Lat.).

Generally distributed in the Hudsonian zone across the continent and southward in the mountains of Alberta and British Columbia, reaching sea-level on the Pacific coast, where it occurs in a large dark form, representing a fairly distinct race. It is also common in the cooler parts of the Canadian zone.

Somatochlora hudsonica Hagen.

Moose Factory, James Bay, Ont. (Walker '25); Fort Albany, James Bay, Ont., June 24, 1 ♀ (F. A. Urquhart); Fort Severn, Hudson Bay, Ont., July 4-15, 3 ♂, 3 ♀ (Walker '41b); Churchill, Man. (Walker '41a); Fort Resolution, Great Slave Lake, N. W. T. (Selys '71); Atlin, B. C. (Whitehouse '41); Fort Yukon, Alaska (Gloyd '39).

A Hudsonian species occurring also in the northern part of the Canadian zone, but not recorded east of Ontario.

Somatochlora cingulata Selys.

Bonavista Bay, Nfd. (Selys '75); Bay of Islands, Nfd. (Williamson '06); Spruce Brook, Nfd. (Walker '16); Great Caribou I., Labrador, July 27 (Allen and Townsend); Hopedale, Labrador, July 9-Aug. 24 (Walker '25); Moisie Bay, Que. (Eidmann '35); Hurricanaw I., Hannah Bay, James Bay, Ont., July

14 (E. S. Pentland); Fort Albany, James Bay, Ont., June 29-July 2, 3 ♀ (F. A. Urquhart); Big Piskwamish, James Bay, Ont., July 21, 1 ♂, 2 ♀ (F. A. Urquhart); mile 256, 332, Hudson Bay Ry., Man. (Walker '25); mile 250, Hudson Bay Ry., July 1, 1942, 1 ♀ (G. S. Brooks).

Although this species enters the Hudsonian zone it appears to be most plentiful in the cooler parts of the Canadian zone, particularly in the Provinces of Quebec and Ontario. It is abundant, e.g., in the Laurentides Park, Que., the north shore of the lower St. Lawrence (Godbout), and Attawapiskat and Favourable Lakes in northern Ontario. It reaches British Columbia (Okanagan Valley, Whitehouse '41), but appears to be rare there and, in general, commoner in the eastern provinces.

Libellula quadrimaculata L.

Bay of Islands, Nfd. (Williamson '06); Spruce Brook, Nfd. (Walker '16); Magdalen Is., Que. (Williamson '02); Moosonee, James Bay, Ont., July 18 (Walker '40); Fort Albany, June 17, 1 ♂ just emerged, June 20, 2 ♂, July 2, 1 ♀ (F. A. Urquhart); Fort Simpson, MacKenzie River, N. W. T., June 25 (C. H. Crickmay): Also recorded from Fox Point and Juneau in southern Alaska (Gloyd '39).

This is another circumpolar species, abundant in Canada all across the continent and entering the Hudsonian zone as indicated by the Fort Albany records.

Sympetrum internum Mont. (*S. decisum* auct., nec. Hagen).

Natashquan, Thunder River and Anticosti I., Que. (Walker '34); Nettitichi Pt., James Bay, Ont. (E. S. Pentland); Moosonee, James Bay, Ont. (Walker '40); Atlin, B. C. (Whitehouse '41). Also reported from Chitina, Alaska (Ahrens '38).

This species has much the same distribution in North America as *L. quadrimaculata* and is one of the commonest dragonflies in Canada. It is chiefly an inhabitant of the Transition and Canadian zones and apparently only reaches the edge of the Hudsonian.

Sympetrum costiferum (Hagen).

Bay of Islands, Nfd. (Williamson '06); Little Buffalo River, N. W. T., Aug. 22 (J. Russell); Bear River, Buffalo Park, N. W. T., Sept. 12 (J. Russell):

A transcontinental species of the Transition and Canadian zones, sometimes abundant, especially on the Central Plains, where it frequents both fresh and saline waters.

Sympetrum danae Sulzer.

St. John's, Nfd., Aug. 26 (coll. ?); Thunder River and Anticosti I., Que. (Walker '34); Wapus River, Reindeer Lake, Sask., Aug. 25, 27, 4 ♀ (D. S. Rawson); Atlin, B. C. (Whitehouse '41). Also reported from Admiralty I. and Juneau, Alaska.

A circumpolar species, common in the Canadian zone across the continent and reaching the Hudsonian at Reindeer Lake, Sask., and Atlin, B. C.

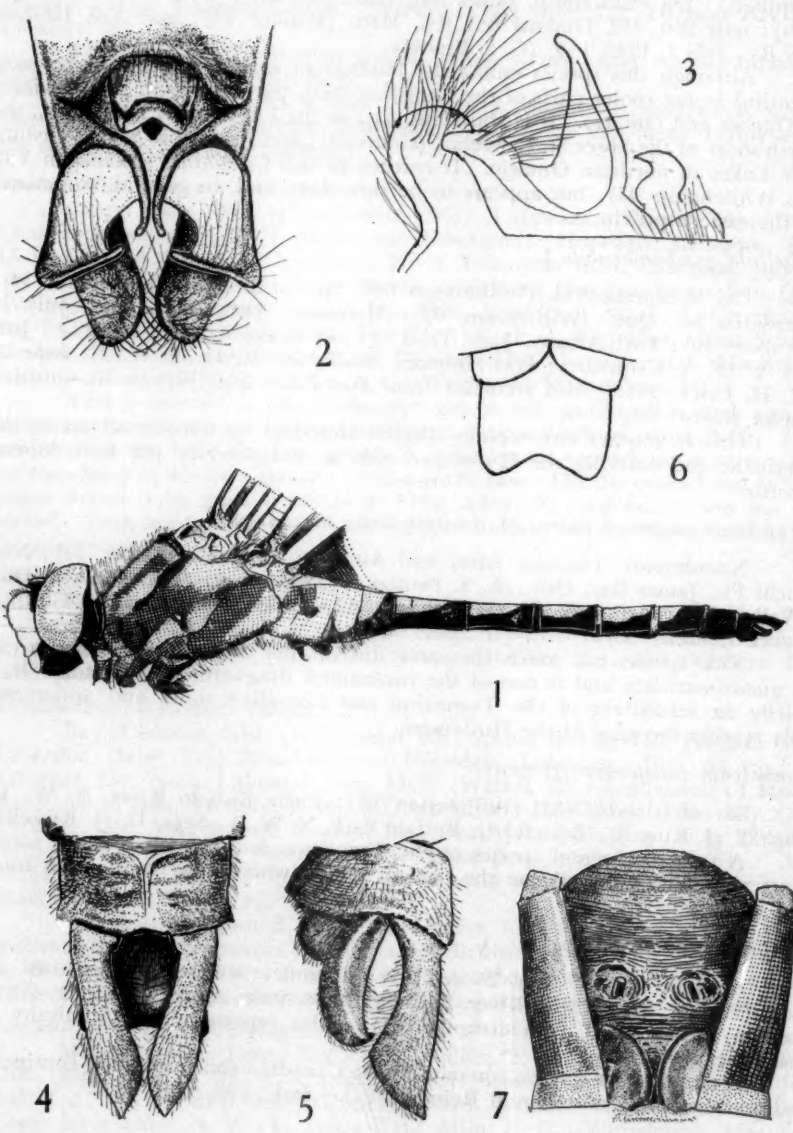
Leucorrhinia borealis Hagen.

Fort Resolution, Great Slave Lake, N. W. T. (Hagen '96); Caribou I., Great Slave Lake, N. W. T., June 26 (J. Russell).

A species of the western half of the Canadian zone, abundant in the northern parts of the prairie provinces and ranging into British Columbia and southern Alaska. It probably enters the Hudsonian to a slight extent.

According to Hagen this species is intermediate between *L. pectoralis* and *L. rubicunda*, both palaearctic forms. While very like these species in the large

PLATE VII



Leucorrhinia borealis Hagen.

1. Lateral view of male.
2. Ventral view of hamuli.
3. Profile of hamulus and genital lobe.
4. Dorsal view of male anal appendages.
5. Lateral view of male anal appendages.
6. Inferior appendage, ventral view.
7. Sternum of segment 9 of female showing vulvar laminae.

size and colour pattern, *L. borealis* appears to be most closely related to *L. hudsonica*, whose nearest Old World relative is *L. dubia* v.d. Lind. This opinion is based upon the structure of the hamuli of the male and the vulvar laminae of the female (see pl. VII, fig. 2, 3, 7).

Leucorrhinia hudsonica (Selys).

Newfoundland (Selys '75); Bay of Islands, Nfd. (Williamson '06); Spruce Brook, Nfd. (Walker '16); St. Lewis Inlet, Labrador, July 12 (Allen and Townsend); Great Caribou I., Labrador, July 27 (Allen and Townsend); Hopedale, Labrador, Aug. 26-30 (W. W. Perrett); Magdalen Is., Thunder River, and Anticosti I., Que. (Walker '34a); Moisie Bay, Que. (Eidmann, '36); Fort Albany, James Bay, Ont., June 12-25, 15 ♂, 7 ♀ (F. A: Urquhart); Fort Severn, Hudson Bay, Ont., June 17-July 20, 60 ♂, 78 ♀ (Walker '41b); Churchill and Ilford, Man. (Walker '41a); Fort Resolution, Great Slave Lake, N. W. T. (Hagen '75); Great Slave Lake region, June 27 (J. Russell); Fort Simpson, MacKenzie River, N. W. T., June 25 (C. H. Crickmay, Rev. J. Keen); Fort Norman, MacKenzie River, N. W. T., June 29 (C. H. Crickmay); Cameron Bay, Great Bear Lake, July 5 (T. N. Freeman); Atlin, B. C. (Whitehouse '41): Also reported from a number of Alaskan localities.

A common species throughout the Canadian and Hudsonian zones from coast to coast. It seems to be the only libellulid that is really abundant in the Hudsonian. It was the commonest dragonfly at Fort Severn to judge from the number of specimens in the collection.

Leucorrhinia patricia Walker.

Fort Albany, James Bay, Ont., June 25, 1 ♀, somewhat teneral (F. A. Urquhart); Fort Severn, Hudson Bay, Ont., July 3-6, 1 ♂, 3 ♀ (Walker '41b, '42).

This species was described from a single male taken in the Favourable Lake region, Patricia section of the Kenora District, Ont. (Walker '40). Since then a series of 6 ♂, 1 ♀, was found in the National Collection, Ottawa, taken at Smoky Falls, on the Mattagami River, near Kapuskasing, Ont., by G. S. Walley (Walker '42).

Leucorrhinia proxima Calvert.

Fort Albany, James Bay, Ont., June 20, 9 ♂, 5 ♀, July 5, 1 ♂ (F. A. Urquhart); Atlin, B. C. (Walker '27). Also recorded from Anchorage, Alaska (Ahrens '38).

There is a female Leucorrhinia in the National Collection from the Great Slave Lake region, taken July 8 by J. Russell, which belongs either to this species or *L. glacialis*. Both of these species will undoubtedly be found to occur widely in the Territories and it is very probable that *L. glacialis* as well as *L. proxima* enters the Hudsonian zone.

ADDITIONAL SPECIES FROM NEWFOUNDLAND

Since the above list consists of Hudsonian species or those which range close to the Hudsonian zone in the Canadian Territories, we place the following species from Newfoundland in an appendix, since their ranges are definitely south of the Hudsonian.

Enallagma ebrium (Hagen).

Grand Lake, Nfd. (Williamson '06); Spruce Brook, Nfd. (Walker '16).

A transcontinental species of wide distribution, commonest in the Transition zone, but ranging well into the Canadian.

Ischnura verticalis (Say).

Spruce Brook, Nfd. (Walker '16).

An abundant species of the eastern half of the Continent, penetrating the Canadian zone but not reaching as high a latitude as the last species.

Aeschna canadensis Walk.

Spruce Brook, Nfd. (Walker '16).

A transcontinental species, commonest in the Transition and lower Canadian zones.

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THE SPRUCE FOLIAGE WORM AND THE SPRUCE CONE WORM (*DIORYCTRIA* SPP., LEPIDOPTERA, PYRALIDAE) *

BY MARGARET R. MACKAY,
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In the literature on forest entomology there has been considerable confusion regarding the true identity of the two species of *Dioryctria* feeding on spruce in North America. Superficially the adults of these species resemble each other so closely that the one is easily mistaken for the other. In seasonal history and habits, however, they differ very materially.

One species, *Dioryctria abietella* D. and S., normally feeds in the young cones and occasionally on the foliage of near-by twigs. It spins its cocoon in the fall and the adults emerge in early June of the following year. The other species, *Dioryctria reniculella* Grt., feeds primarily on the foliage of the terminal shoots; the larvae mature in June and the adults emerge in July.

Morphologically, the species feeding on cones appears to be identical with the European *Dioryctria abietella* of Denis and Schiffermüller. Comparison of the adults of this form with two specimens (male and female) from Finland, labelled *D. abietella* (National Collection, Ottawa) revealed no specific differences in wing venation, genitalia, palpi, or antennae. Moreover, Ratzeburg's (5) account of the life history of *abietella* and his description of the larva agree substantially with those of the American species feeding on spruce cones as recorded by the Canadian Forest Insect Survey and referred to by Brown (1). For these reasons it is considered that the 'spruce cone worm' of Packard's fifth report (4) was mistakenly determined by Fernald as *A. reniculella* Gr. instead of *D. abietella* D. & S. This error has misled many subsequent authors.

The original description of *D. reniculella* is inadequate since it reveals no reliable points of difference from *D. abietella* in the gross examination of the adult. Grote makes no mention of the life-history or the larvae. There seems, however, to be no reason why this description should not apply to the adult of the foliage species. Specialists of the United States National Museum and the Canadian National Collection concur in this view. A detailed description of the stages and life-history of the two species are set forth below.

Dioryctria reniculella Grote

Adult (Pl. VIII, Fig. 1)

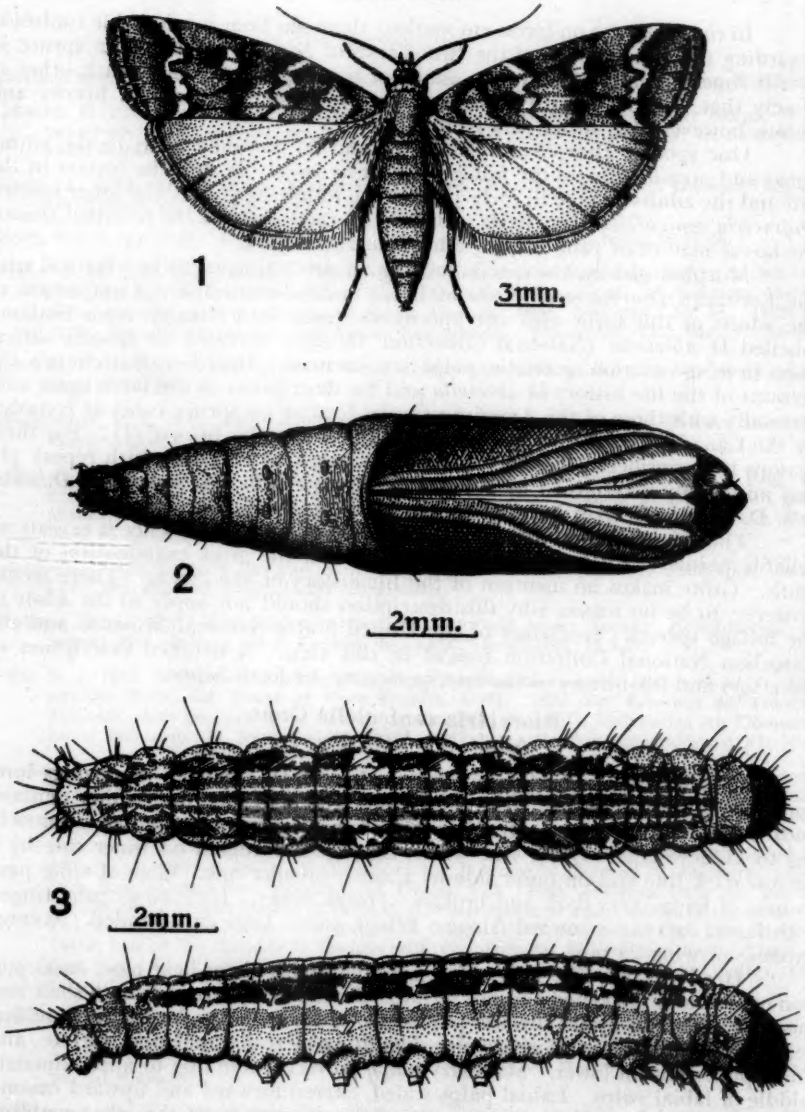
Colour pattern of wings similar to that of *D. abietella*. Forewings long and narrow, brownish-grey in general colouration. Inner line white, dentate, with a dark distal border. Reniform white, prominent, rectangular, approaching to kidney-shape. Outer line white, zigzagged, bordered on inner side by a narrow dark line and on outer side by a much broader one. Edge of wing next to base of fringe very dark and broken. Fringe dusky. Hindwings pale, tinged with fawn, darkening toward fringe. Fringe pale. Legs dark-banded. Average expanse of wing 25 mm.

Head (Pl. IX, Fig. 4, 5): Male antenna slightly bent near base, basal portion or shoulder thickened and not serrated. Shaft shortly serrated; both shaft and shoulder scaled on upper surface, pubescent on lower; scales larger on shoulder. Female antenna simple, more slender than in male, scaled on upper surface, and finely pubescent on lower. Maxillary palps porrect, extending to approximately middle of labial palps. Labial palps scaled, curved forward and upward beyond vertex, their usual position being some distance away from the eyes, enabling one to observe maxillary palps in lateral view; first segment usually light coloured or with more light-coloured scales than dark ones. Occiput similarly coloured.

Venation (Pl. IX, Fig. 1, 3): Forewing with eleven veins; inner

*Contribution No. 2191, from the Division of Entomology, Science Service, Department of Agriculture, Ottawa. This is the eighth in a series of contributions from the Canadian Forest Insect Survey.

PLATE VIII



THE SPRUCE FOLIAGE WORM AND THE SPRUCE CONE WORM, *DIORYCTRIA* SPP.

portion of veins 7+8 ($R_3+_4+_5$) runs almost parallel to vein 9 (R_2) at a distance of approximately 1/10 mm. for a short distance before diverging; veins 4 (M_3) and 5 (M_2) originate separately but inner portions of each run close together; discal crossvein may come off at junction of 7+8 ($R_3+_4+_5$) with 6 (M_1) or may arise from 6 (M_1) a short distance beyond junction. Hindwing with eight veins; veins 4 (M_3) and 5 (M_2) independent but running close together and in places almost fusing, for approximately half their lengths.

Genitalia, ♂ (Pl. X, Fig. 1, 1a): Uncus sagittate. Small, almost blunt spine present on ventral edge of costal part of clasper a short distance from tip; sacculus covered with numerous long hairs; apex of clasper acutely pointed. Vinculum long and broadly cuneiform with lateral edges slightly concave. Arms of anellus long, slender, clavate, and sparsely bristled at tips. Aedeagus long and slender, with cornuti clusters present. Measurements of ♂ genitalia illustrated; length 4 mm., width .9 mm.

Well-developed secondary structures, underlying the genitalia, consisting of five pairs of hair pencils (Pl. X, Fig. 2). The uppermost pair (in ventral view) is broad, flat, and scaled at tips; three pairs are long and slender. The fifth pair lies posterior to the others and is considerably modified, being broad and flat for most of the length, but curving sharply ventro-anteriorly to end in blunt tips; two pairs of prominences apparent in region of curves, one pair more or less rectangular in shape, the other pair larger with sharp points on the outer surfaces and attached to the pencils dorsally and anterior to the curves. Each pencil appears to divide, one part curving, and the other continuing straight. A small chitinous structure lies dorsal to pencils, flatly triangular in shape but with sides of triangle concave; slender projections extend anteriorly from its base to form a continuation of the sides of the triangle and eventually attach themselves to the base of the entire structure. A bilobed membrane is present beneath the chitinous structure and appears to fuse with its projections.

♀ (Pl. X, Fig. 3): Ductus bursae long, broad, flat and chitinized with the anterior end developed into something like a large lateral spur which curves posteriorly. Bursa copulatrix elongate and twisted. Ductus seminalis arises from bursa on side opposite spur-like development of ductus bursae, at the junction between the bursa and the ductus bursae. No signum present.

Pupa (Pl. VIII, Fig. 2)

Length of specimen illustrated, 12.2 mm. Of the usual phycid appearance, dark brown in colour, with the characteristics of the sub-family Phycitinae, namely: a dorsal suture on the abdomen between the ninth and tenth segments, and the presence of maxillary palps. Head with a prominent cephalic projection. Cremaster poorly developed, its ventral surface flattened, with a crenated edge, on which are six hooked setae of equal length.

Larva, last instar (Pl. VIII, Fig. 3)

Measurements of specimen illustrated: head width 1.3 mm., body length 17 mm. and width 2.2 mm.; fusiform in general shape, each segment divided into broad anterior and narrower posterior portions. Ground colour pale yellow, with several well-defined longitudinal lines composed of the following: a narrow cinnamon mid-dorsal line flanked by paired addorsal lines of same width and colour; lateral lines broad, dark brown, with lighter patches in anterior sections of the segments, extending from the second thoracic to the seventh or eighth abdominal segments inclusive; spiracular line broad, cinnamon coloured; cervical shield cinnamon, anal shield ground colour with mid-dorsal and addorsal lines fading into it; venter ground colour with longitudinal patches of cinnamon, and darker areas at the bases of the prolegs. Head dark brown and transversely wrinkled. Spiracles circular, central part ground colour, rimmed with black. Thoracic legs dark brown, almost black; abdominal legs ground colour. Setae conspicuous; areas around bases of lateral setae on the second thoracic segment

and the eighth abdominal segment are light coloured, slightly raised, and encircled by dark brown.

Life Cycle

The hosts of the 'spruce foliage worm' are white spruce, black, Englemann, and blue spruce, and very occasionally balsam fir, tamarack and jack pine. It overwinters probably as a young larva. Fully grown larvae are to be found in late June and early July.

Pupation occurs from June 6 to July 22. Emergence follows from six to ten days later (June 16 to July 28). There is one generation and approximately an equal division of sexes.

An interesting occurrence was noted by F. B. Rabkin in northwestern Ontario, where the spruce foliage worm was definitely observed to be predaceous on jack pine budworm; and at Sutherland, Saskatchewan, it has been found feeding in the cones, although it feeds characteristically on the foliage of the terminal shoots.

Geographical Distribution

In Canada, at the present time, the region of greatest abundance of the spruce foliage worm is the district of Algoma, from the north channel of Lake Superior north to Gogama and Chapleau. It generally occurs in areas infested by spruce budworm (*Cacoecia fumiferana* Clem.), which has been present in that region since 1936. It has also been recorded as abundant in Cape Breton Island in 1926, again together with the spruce budworm. The known range of this species, at present, includes the interior of British Columbia, central Saskatchewan, and southern Manitoba. In eastern Canada it ranges from the northern Ontario clay belt to the Côté Nord, Gaspe and Cape Breton, and south to Lake Ontario and the valley of the St. John River.

Dioryctria abietella Denis and Schiffermüller

The species *Dioryctria abietella* has been described, figured, and discussed by several authors. Perhaps the most complete description is that given by Packard (4), in which reference is made to the adult, pupa, larva, and life history, although unfortunately, under the incorrect name of *D. reniculella*. The venation of the adult *abietella* is mentioned by Grote when he states that in the hindwing, vein 5 joins the median vein close to the origin of veins 4 and 3 (2). This, however, is too indefinite a character with which to identify specimens of this species. The male genitalia have been illustrated in a monograph by H. Thomann, R. Standfuss, and J. Muller-Rutz (6). Ratzeburg (5) has good illustrations of the larva and the adult, together with a short discussion of the life-history from observations made by Zinnchen.

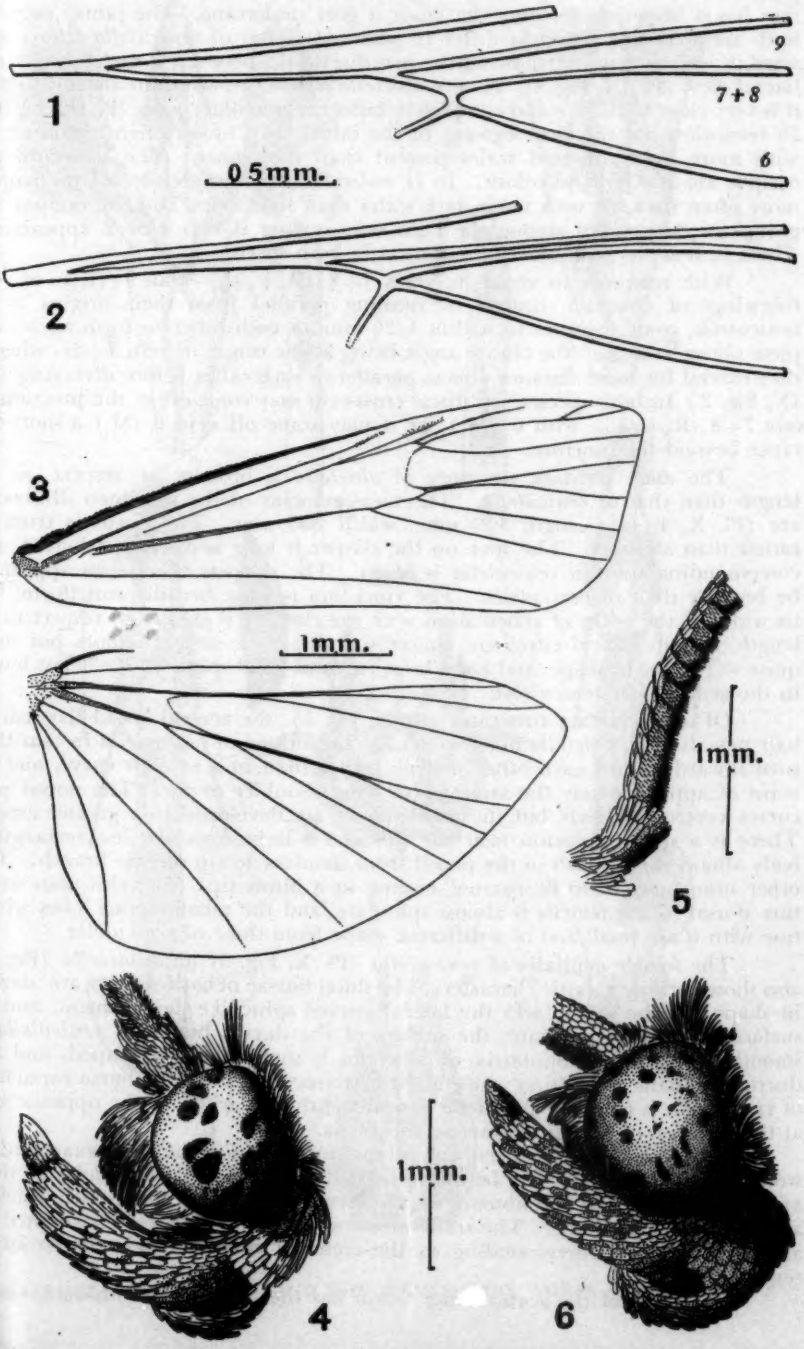
In Canada, as shown by the results of the Forest Insect Survey (1), the spruce cone worm is found on the cones, twigs, and buds of white spruce, and very occasionally on the inner bark at the base of young white pine. The larva appears in August and cocooning occurs from September 20 to October 12. It overwinters within a light cocoon as a prepupa, and the adult emerges in the early part of the following June. Its range extends from central Saskatchewan and Lake Winnipeg to Algoma, western Quebec, New Brunswick and Nova Scotia, and south to the Ottawa Valley.

The form on the Pacific coast attacking Douglas fir cones and white pine stems is generally considered to be *D. ponderosae* Dyar. The characters of the species are not sufficiently distinctive to eliminate the possibility of its synonymy with *D. abietella*. Examination of a single specimen of the male genitalia strongly confirms this view.

On the European continent, *D. abietella* ranges from western Europe across to Siberia and Japan. It is probably circumpolar in distribution.

Comparison of *D. reniculella* with *D. abietella*

PLATE IX



THE SPRUCE FOLIAGE WORM AND THE SPRUCE CONE WORM, *DIORYCTRIA* SPP.

The adults of the two species differ in several respects. The wing colour pattern of *reniculella* appears to be more distinct than that of *abietella*; the former has a brown undertone, the latter a grey undertone. The labial palps of both are alike but generally differ in position. That of *reniculella* curves outward as well as upward, showing the maxillary palp between it and the eye in a lateral view (Pl. IX, Fig. 4). That of *abietella* curves upward quite sharply so that it is very close to the eye and completely hides the maxillary palp (Pl IX, Fig. 6). *D. renicullea* has the first segment of the labial palp usually light coloured, or with more light coloured scales present than dark ones. The scales on the occiput are also light in colour. In *D. abietella,* the first segment of the palp is more often dark, or with more dark scales than light ones, and the occiput has groups of dark scales among the light ones, giving it also a dark appearance. There is, however, considerable variation in both species.

With reference to venation, veins 7+8 ($R_3+_4+_5$) and 9 (R_2) of the forewings of *abietella,* instead of running parallel from their origins as in *reniculella,* come together to within 1/20 mm. ot each other to form an incomplete obtuse triangle (the obtuse angle being at the origin of vein 7+8), whence they extend for some distance almost parallel to each other before diverging (Pl. IX, Fig. 2.) In both species, the discal cross-vein may come off at the junction of vein 7+8 ($R_3+_4+_5$) with 6 (M_1), or it may come off vein 6 (M_1) a short distance beyond the junction.

The male genitalic structure of *abietella* is broader in respect to its length than that of *reniculella.* The measurements of the specimen illustrated are (Pl. X, 4, 4a): length 3.25 mm., width 1.15 mm. The uncus is truncate rather than sagittate. The spur on the clasper is long and sharp, whereas the corresponding spur in *reniculella* is blunt. The claspers themselves appear to be broader than in *reniculella.* The vinculum is long, broadly cuneiform, but its width at the point of articulation with the claspers is greater in respect to its length, and its lateral edges are almost straight. The aedeagus does not seem quite so regular in shape, and has a large internal basal spine, which is not found in the aedeagus or *reniculella.*

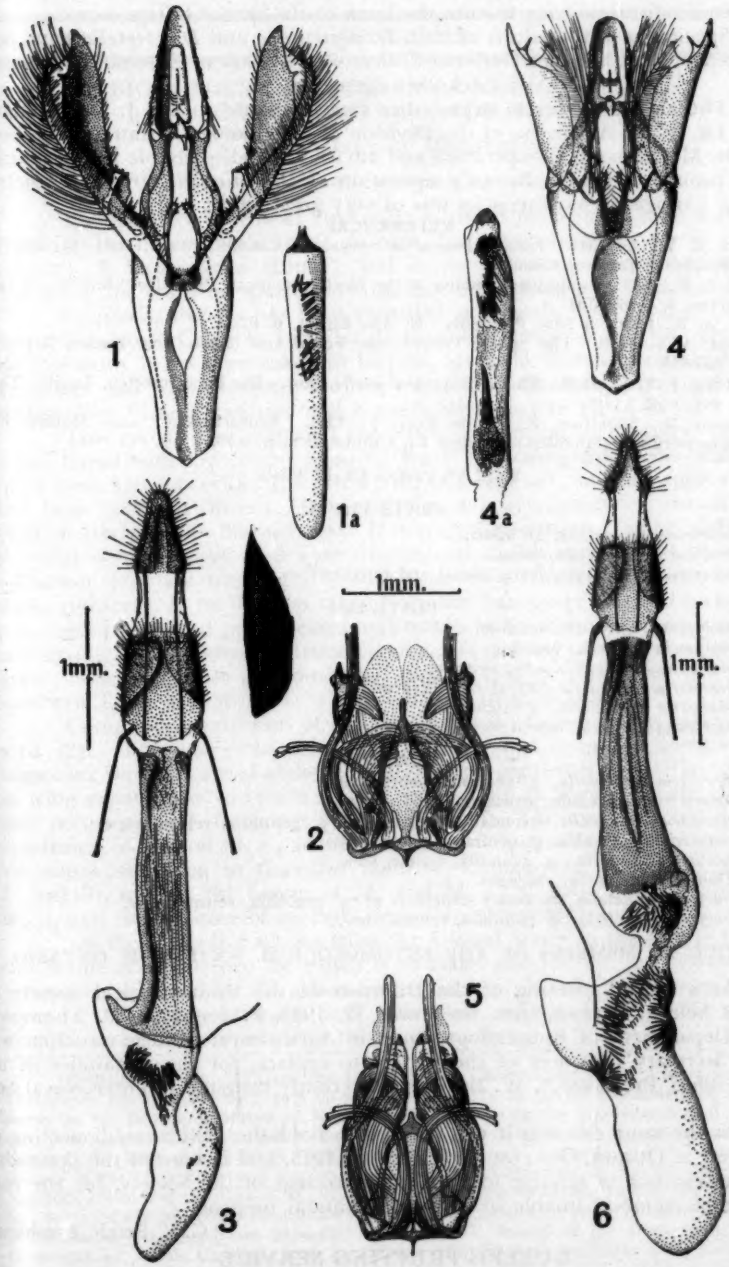
Of the secondary structures (Pl. X, Fig. 5), the ventral broad flat pair of hair pencils of *D. abietella* differ somewhat from those of *reniculella* in that they turn inward toward each other sharply rather than in a smooth curve, and remain of approximately the same width from shoulder to tip. The dorsal pair curves ventro-anteriorly but the prominences are developed to a greater extent. There is a slight elevation near the tip, and a large, more or less rectangular body almost the breadth of the pencil from shoulder to tip on one branch. The other branch seems to be narrow, ending in a blunt tip. The chitinous structure dorsal to the pencils is almost spatulate, and the membranous lobes which fuse with it are small and of a different shape from those of *reniculella.*

The female genitalia of *reniculella* (Pl. X, Fig. 3) and *abietella* (Fig. 6) also show definite specific characters. The ducti bursae of both species are similar in shape but the latter lacks the lateral curved spine-like development, and its surface is strongly scobinate; the surface of the ductus bursae of *reniculella* is smooth. The bursa copulatrix of *abietella* is somewhat boot-shaped, and the ductus seminalis arises from what might be termed the heel; the bursa copulatrix of *reniculella* is elongate and twisted, and the ductus arises on the opposite side at the junction of the ductus bursae and bursa.

Although only two specimens of the pupa of *abietella* were examined, it would appear that they may be differentiated from those of *reniculella* by their amber colouring, and the absence of the cremaster on the caudal end, which is almost bulbous in shape. The transverse row of six hooked setae is situated on an irregular ridge, corresponding to the crenated edge of the cremaster in *D. reniculella.*

The larva of the spruce cone worm has the head and prothoracic shield

PLATE X



THE SPRUCE FOLIAGE WORM AND THE SPRUCE CONE WORM, *DIORYCTRIA* SPP.

of deep amber brown, and the body reddish carneous or amber brown, with faint, dark, dorsal, and broader subdorsal lines. There can, therefore, be no difficulty in distinguishing it from the larva of the spruce foliage worm.

Specimens of the adults of both *D. reniculella* and *D. abietella* have been deposited in the Canadian National Collection, Division of Entomology, Ottawa.

Acknowledgements

The author wishes to express her sincere thanks to Dr. J. McDunnough and to Dr. A. W. A. Brown, of the Division of Entomology, Ottawa. The benefit of Dr. McDunnough's experience and advice was indispensable in the solution of this problem, and Dr. Brown's separation of *D. reniculella* from *D. abietella* by their biological characteristics was of very great value.

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EXPLANATION OF PLATES

PLATE VIII

Fig. 1, *Dioryctria reniculella*, ♀ adult.
Fig. 2, *Dioryctria reniculella*, pupa.
Fig. 3, *Dioryctria reniculella*, larva, dorsal and lateral views.

PLATE IX

Fig. 1, *Dioryctria reniculella*, venation.
Fig. 2, *Dioryctria abietella*, venation.
Fig. 3, *Dioryctria reniculella*, wing venation.
Fig. 4, *Dioryctria reniculella*, lateral view of head, ♂.
Fig. 5, *Dioryctria reniculella*, ♂ antenna.
Fig. 6, *Dioryctria abietella*, lateral view of head, ♂.

PLATE X

Fig. 1, *Dioryctria reniculella*, ♂ genitalia, ventral view.
Fig. 1a, *Dioryctria reniculella*, aedeagus.
Fig. 2, *Dioryctria reniculella*, secondary structures of ♀ genitalia, ventral view.
Fig. 3, *Dioryctria reniculella*, ♀ genitalia, ventral view.
Fig. 4, *Dioryctria abietella*, ♂ genitalia, ventral view.
Fig. 4a, *Dioryctria abietella*, aedeagus.
Fig. 5, *Dioryctria abietella*, secondary structures of ♂ genitalia, ventral view.
Fig. 6, *Dioryctria abietella*, ♀ genitalia, ventral view.

NOTICE TO MEMBERS OF THE ENTOMOLOGICAL SOCIETY OF ONTARIO

At a special meeting of the Directors of the Entomological Society of Ontario, held at Ottawa, Ont., on March 17, 1943, Professor R. W. Thompson of the Department of Entomology, Ontario Agricultural College, Guelph, was elected Secretary-Treasurer of the Society to replace, for the remainder of his term of office, Professor A. W. Baker, who recently resigned to enter Naval Service.

At the same meeting it was decided to hold the next annual meeting of the Society at Ottawa, Ont., on November 10, 1943, and in view of the prevailing travel restrictions to arrange for sectional meetings of the Society, for the convenience of members unable to attend the annual meeting.

C. E. Petch, President.

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